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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE



In re Patent Application of

David J. Cooperberg et al.

Application No.: 10/024,208

Filed: December 21, 2001

For: TUNABLE MULTI-ZONE GAS
INJECTION SYSTEM

) Confirmation No. 9076
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) Group Art Unit: 1763
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) Examiner: Luz L. Alejandro Mulero
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) Appeal No.: Unassigned
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REPLY BRIEF

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Appellants respectfully submit that each of the outstanding rejections should be reversed for at least the following reasons.

I. All Independent Claims on Appeal Recite a "Common Gas Supply"

Each of the independent Claims 1, 7, 9, 10 and 41 recites a gas injector and "a common gas supply in fluid communication with a first gas line and a second gas line." The first and second gas lines are in fluid communication with respective on-axis and off-axis gas outlets in the gas injector. Claim 42 recites a gas injector and "a common gas line in fluid communication with the first gas passage and the second gas passage [of the gas injector]" (Appeal Brief at page 8, last paragraph). In the claimed invention, the "common gas supply" is adapted to supply a common gas to the on-axis and off-axis outlets at the same time, thereby allowing optimal gas injection into the processing chamber to process a substrate (Appeal Brief at paragraph bridging pages 4-5).

II. Chang and Murugesh both Require Two Gas Supplies

Chang (WO 99/57747) discloses an apparatus that is specifically designed to deposit a titanium containing film in a single process chamber (Chang at, for example, the Abstract and page 4, lines 7-10). As shown in FIG. 1, Chang's gas injector structure requires two separate deposition gas supplies to be able to simultaneously supply two different process gases to the respective top gas nozzle 96 and the top vent 98 (Appeal Brief at paragraph bridging pages 15-16). The two different process gases (hydrogen and titanium tetrachloride) are required for the chemical reaction that forms a titanium film on the substrate processed in the chamber (Chang at page 2, lines 29-31).

Chang depicts another embodiment of the gas injector structure in FIG. 7. As shown, titanium tetrachloride gas 96a is flowed from the top gas nozzle 96 and hydrogen gas 98a is concurrently flowed from the top vent 98. According to Chang, the hydrogen gas 98a reduces unwanted deposition of a titanium film within the process chamber (Chang at page 18, line 32 to page 19, line 1). Titanium tetrachloride gas 96a is flowed toward the substrate on which the titanium film is formed. Accordingly, this embodiment of Chang's gas injector structure also requires two different process gas supplies.

The gas distributor structure disclosed by Murugesh (U.S. Patent No. 6,450,117) also requires two separate gas supplies to be able to operate in the designed manner. Namely, the gas distributor structure shown in FIG. 3 of Murugesh requires a process gas supply 70 to supply a process gas into the chamber via gas outlets 85 to process a substrate, and a cleaning gas supply 125 to

supply a cleaning gas into the chamber via gas outlets 247 to clean a selected portion of the chamber (Appeal Brief at page 14, line 19 to page 15, line 16).

III. Modifying Chang's or Murugesh's Apparatus to have a "Common Gas Supply" goes Directly Against their Teachings

The Examiner contends that it would have been obvious to modify the apparatus of Chang (modified by Murugesh) to comprise a common gas supply that supplies the same gas to the processing chamber through the "on-axis outlet and the off-axis outlets" (Examiner's Answer at page 7, lines 12-18). However, these contentions completely disregard and go directly against the teachings of both Chang and Murugesh that would have led one having ordinary skill in the art away from the proposed modification of the base reference Chang (see, for example, the paragraph bridging pages 16-17 of the Appeal Brief).

The modification of Chang proposed by the Examiner would destroy Chang's apparatus for the particular purpose that it was designed to achieve, i.e., depositing a titanium film, which requires using two different process gases that react in the chamber to form the film (see point (c) at pages 17-18 of the Appeal Brief).

Thus, there would have been no motivation for one having ordinary skill in the art to modify Chang in the manner proposed in the final Office Action.

IV. The Examiner has Disregarded Legal Standards Under 35 U.S.C. § 103

At page 12, lines 13-17, of the Examiner's Answer, the Examiner states, without citing to any supporting legal authority:

In response to applicant's argument that the Murugesh et al. apparatus operates differently than the Chang apparatus, and therefore, the combination is improper, the examiner respectfully wants to point out that the way an apparatus operates and/or is

used has no relevancy as to whether the references can be combined under 35 U.S.C. § 103. (Emphasis added).

See also the similar statement at page 13, lines 20-21 of the Examiner's Answer.

At page 12, last line, to page 13, line 3, of the Examiner's Answer, the Examiner states, again without citing any supporting legal authority, that:

[T]he arguments are related to the intended uses of the apparatus of Chang or the intended uses of the apparatus of Muruges et al., which are not particularly relevant to the claimed invention since the claimed invention is directed to an apparatus invention. (Emphasis added).

See also the similar statement at page 13, line 21 to page 14, line 2, of the Examiner's Answer.

These statements are directly contradictory to the legal standards regarding combined-reference obviousness discussed at page 11 of the Appeal Brief. The Examiners' contentions amount to the position that these legal standards are non-existent. However, a prior art reference must be considered as a whole, including those portions of the reference that would have led away from the claimed invention. See M.P.E.P. § 2142.02 at page 2100-127. It is improper to combine references where the references teach away from the combination. See M.P.E.P. § 2145(X)(2) at page 2100-162.

In addition, the effect of a proposed modification on the intended function, operability and principle of operation of a base reference must be considered in the determination of patentability of claimed subject matter under 35 U.S.C. § 103. The proposed modification of a base reference cannot render it unable to achieve its

intended purpose or function, or destroy the basic principle of operation taught by the base reference. Accordingly, legal precedent requires that the references be analyzed to determine how they would be affected by the proposed modification, as this determination goes directly to the issue of motivation for the proposed modification.

Appellants submit that because the Examiner has disregarded legal authority that directly refutes the positions advanced in the final Office Action, but according to which the applied references do not support the alleged *prima facie* obviousness, the ground(s) of rejection should be reversed.

V. The Applied References do Not Suggest Modifying Chang's Gas Injector Structure to Produce the Claimed Gas Injector Structure

Claim 1, for example, recites a plasma processing system comprising, *inter alia*, "a gas injector ... comprising a body including an axial end surface exposed within the processing chamber, a side surface extending axially from the axial end surface, and a plurality of gas outlets including at least one on-axis outlet in the axial end surface and a plurality of spaced-apart off-axis outlets in the side surface" (emphasis added). The exemplary gas injector shown in Fig. 2a of the present application includes off-axis outlets in the side surface that extends axially from the axial end surface including at least one on-axis outlet in the axial end surface.

The Examiner acknowledges that Chang does not disclose a gas injector including a plurality of gas outlets including at least one on-axis outlet in the axial end surface and a plurality of spaced-apart off-axis outlets in the side surface (Examiner's Answer at page 6, lines 6-8). As shown in FIG. 1 of Chang, the top vent 98 is a flow passage located between the wall defining the top gas nozzle 96 and the

surrounding outer wall of the gas injector structure. The top vent 98 is not an outlet in either of these two walls. Chang's structure does not include the recited plurality of spaced-apart off-axis in a side surface of the body of the gas injector.

FIG. 1 of Chang also shows that the top vent 98 is disposed above the dome 50. As such, the Examiner has established no motivation to modify the outer wall of Chang's gas injector structure, which defines the top vent 98, to include the recited plurality of spaced-apart off-axis outlets in the side surface of that wall because gas introduced through the top vent 98 would not even be introduced into the chamber via such off-axis outlets located above the dome 50.

Also, the Examiner has provided no motivation to modify the inner wall of Chang's gas injector structure that defines the top gas nozzle 96 to include the recited plurality of spaced-apart off-axis in the side surface of that wall, as such modification would allow gas supplied through the top gas nozzle 96 to exit from those off-axis outlets and mix with different gas inside the top vent 98, which would thereby prevent the separate introduction of these two gases in different directions into the chamber.

Thus, because the proposed modification of Chang's structure goes directly against Chang's teachings and would result in a structure that cannot achieve Chang's intended purpose, there would have been no motivation for such modification. Therefore, the ground(s) of rejection should be reversed.

VI. Modifying or Replacing Chang's Gas Injector Structure with Murugesh's Structure Also Would Not Produce the Claimed Invention

The Examiner proposes modifying Chang's gas injector structure in light of Murugesh's gas distributor structure, i.e., not entirely replacing Chang's structure

with Murugesh's structure, but instead choosing only selected features from Murugesh's structure and incorporating them into Chang's structure. For example, see the Examiner's Answer at page 12, lines 6-12 (regarding features recited in Claim 1); page 15, first full paragraph (regarding features recited in Claim 5); and page 17, first full paragraph (regarding features recited in Claim 7). The Examiner's rationale requires ignoring other features of Murugesh's structure that clearly differ from features of the claimed invention.

The Examiner appears to also propose entirely replacing Chang's gas injector structure with Murugesh's gas distributor structure (Examiner's Answer at page 6, lines 18-20).

However, neither one of these two manners of modifying Chang's gas injector structure would result in the claimed subject matter. For example, Claim 5, which depends from Claim 1, recites the features of "the injector body is cylindrical shaped and the off-axis outlets are circumferentially spaced apart." Murugesh's gas distributor structure shown in FIG. 3 does not have a cylindrical shaped injector body. Accordingly, replacing Chang's gas injector structure with Murugesh's gas distributor structure would not result in the combination of features recited in Claim 5. The Examiner has also not established that Chang's gas injector structure has a cylindrical shaped body, as asserted in the Examiner's Answer.

Independent Claim 7 recites, *inter alia*, the features of "a gas injector ... including a planar axial end face having an on-axis outlet therein and a conical side surface having off-axis outlets therein" (emphasis added). Murugesh's gas distributor structure shown in FIG. 3 does not have "a conical side surface having off-axis outlets therein." Accordingly, replacing Chang's gas injector structure with

Murugesh's gas distributor structure would not result in the combination of features recited in Claim 7. Moreover, the Examiner has not established that Chang's gas injector structure includes (a) a planar axial end face having an on-axis outlet therein or (b) a conical side surface having off-axis outlets therein, nor any motivation to modify Chang's gas injector structure to include these features.

Accordingly, modifying or replacing Chang's gas injector structure in view of Murugesh's gas distributor structure would not result in a structure that includes every feature of the claimed invention. Therefore, the ground(s) of rejection should be reversed. See M.P.E.P. § 2143.03.

VII. Modifying Chang's Gas Injector Structure According to Murugesh's Teachings Would Not Optimize Film Deposition on a Substrate

Murugesh's gas distributor structure shown in FIG. 3 includes second gas outlets 247 oriented in a specific direction to supply a cleaning gas toward a wall of the chamber to clean the chamber (Appeal Brief at page 14, line 19 to page 15, line 16). The cleaning gas is supplied from the cleaning gas supply 125 into the chamber via outlets 247 after the process gas 70 has been supplied from the process gas supply 70 into the chamber. Modifying Chang's gas injector structure to incorporate the second gas outlets 247, which are oriented to direct the cleaning gas toward a chamber wall (see FIG. 1 of Murugesh), would not optimize titanium film deposition on a substrate in Chang's apparatus. Accordingly, Murugesh provides no motivation to modify Chang's gas injection system for this reason.

XIII. Conclusion

Therefore, reversal of each of the outstanding rejections is earnestly solicited.


No fee is believed to be due for this reply. However, the Commissioner is hereby authorized to charge any fees that may be required by this paper, and to credit any overpayment, to Deposit Account No. 02-4800.

Respectfully submitted,

Buchanan Ingersoll PC (INCLUDING THE ATTORNEYS
FROM BURNS DOANE SWECKER & MATHIS)

Date September 27, 2005

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